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10/550,855	09/18/2006	Hans Von Kaenel	PUS-E005-013	3611

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EXAMINER

MCCALL SHEPARD, SONYA D

ART UNIT	PAPER NUMBER
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2813

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06/02/2009

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/550,855	Applicant(s) VON KAENEL, HANS	
	Examiner Sonya D. McCall-Shepard	Art Unit 2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 23 April 2009.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-22 is/are pending in the application.
- 4a) Of the above claim(s) 18-22 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-17 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>6/20/06</u> . | 6) <input type="checkbox"/> Other: _____ |

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DETAILED ACTION

Election/Restrictions

1. Claims 18-22 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim.

Election was made **without** traverse in the reply filed on 23 April 2009.

Specification

2. The abstract of the disclosure is objected to because the abstract should be in narrative form and should not exceed 15 lines of text. Correction is required. See MPEP § 608.01(b).

Claim Objections

3. Claim 5 is objected to because of the following informalities: line 2, the term “close” in “...close to 0 Volts” is relative. Appropriate correction is required.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1, 3, 4, 5, 7, 8, 14, 15 and 17 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Rosenblad et al. "Low-temperature heteroepitaxy by LEPECVD", Thin Solid Films 318 (1998) pp. 11-14.

With regard to claim 1, Rosenblad et al. disclose a method for forming a highly relaxed semiconductor layer SiGe, with a thickness between 100 nm and 800 nm in a growth chamber with gas inlet, comprising the steps: providing a substrate in the growth chamber on a substrate carrier (p. 11, right-hand column, paragraph 1), establishing a high-density, low-energy plasma in the growth chamber such that the substrate is being exposed to the plasma, directing Silane gas (SiH_4) and Germane gas (GeH_4) through the gas inlet into the growth chamber, the flow rates of the Silane gas and the Germane gas being adjusted in order to form said semiconductor layer by means of low-energy plasma enhanced chemical vapor deposition with a growth rate in a range between 1 and 10 nm/s, said semiconductor layer having a Germanium concentration x in a range between $0 < x < 50\%$ (p. 11, right-hand column, paragraph 1 – p. 14, left-hand column, paragraph 1).

While Rosenblad et al. disclose maintaining a constant substrate temperature of the substrate in a range between 200°C and 700°C and a T_s during growth of 550°C (p. 11, right-hand column, paragraph 1 – p. 14, left-hand column, paragraph 1). This claim limitation is prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re

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Huang, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and In re Aller, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious). It would have been obvious to one having ordinary skill in the art at the time the invention was made to adjust the temperature from 200°C and 700°C to 350°C and 500°C. The motivation is to use an optimal value to increase the growth rate of the semiconductor layer.

With regard to claim 3, Rosenblad et al. disclose a substrate temperature maintained constant during the formation of the semiconductor layer, the substrate temperature preferably having a fluctuation of $\pm 5\%$ (p. 11, right-hand column, paragraph 1 – p. 14, left-hand column, paragraph 1).

With regard to claim 4, Rosenblad et al. disclose a substrate is a <100> or <111> oriented silicon wafer or a Silicon-on-Insulator (SOI) substrate (p. 11, right-hand column, paragraph 1 – p. 14, left-hand column, paragraph 1).

With regard to claim 5, Rosenblad et al. disclose a substrate has a potential of about -12 Volts and the plasma potential is close to 0 Volts (p. 11, right-hand column, paragraph 1 – p. 14, left-hand column, paragraph 1).

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With regard to claim 7, Rosenblad et al. disclose an uppermost part of the substrate is treated by means of a dry-etching or wet-etching step prior to the forming of the semiconductor layer (p. 11, right-hand column, paragraph 1 – p. 12, left-hand column, paragraph 1).

With regard to claim 8, Rosenblad et al. disclose a substrate temperature is in a range between 380°C and 420°C (p. 11, right-hand column, paragraph 1).

With regard to claim 14, Rosenblad et al. disclose a second substrate temperature (T_{s2}) is in a range between the substrate temperature (T_s) used during the forming of the semiconductor layer and the substrate temperature (T_s) minus 50°C (p. 14, left-hand column, paragraph 1).

With regard to claim 15, Rosenblad et al. disclose a growth chamber is a high-density, low-energy plasma enhanced chemical vapor deposition (LEPECVD) chamber (p. 11, right-hand column, paragraph 1).

With regard to claim 17, Rosenblad et al. disclose a total reactive gas flow at the gas inlet is chosen between 5 sccm and 50 sccm (p. 11, right-hand column, paragraph 1 – p. 14, left-hand column, paragraph 1).

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7. Claims 1 and 9 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Rosenblad et al. "Epitaxial growth at high rates with LEPECVD", Thin Solid Films 336 (1998) pp. 89-91.

With regard to claim 1, Rosenblad et al. disclose a method for forming a highly relaxed semiconductor layer SiGe, with a thickness between 100 nm and 800 nm in a growth chamber with gas inlet, comprising the steps: providing a substrate in the growth chamber on a substrate carrier (p. 89, right-hand column, paragraph 1 – p. 90, right-hand column, paragraph 3), establishing a high-density, low-energy plasma in the growth chamber such that the substrate is being exposed to the plasma, directing Silane gas (SiH_4) and Germane gas (GeH_4) through the gas inlet into the growth chamber, the flow rates of the Silane gas and the Germane gas being adjusted in order to form said semiconductor layer by means of low-energy plasma enhanced chemical vapor deposition with a growth rate in a range between 1 and 10 nm/s, said semiconductor layer having a Germanium concentration x in a range between $0 < x < 50\%$ (p. 89, right-hand column, paragraph 1 – p. 90, right-hand column, paragraph 3).

While Rosenblad et al. disclose maintaining a constant substrate temperature of the substrate in a range between 350°C and 600°C and a T_s during growth of 550°C (p. 89, right-hand column, paragraph 1 – p. 90, right-hand column, paragraph 3). This claim limitation is prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA) (discovery of

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optimum value of result effective variable in known process is ordinarily within skill of art) and In re Aller, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious). It would have been obvious to one having ordinary skill in the art at the time the invention was made to adjust the temperature from 350°C and 600°C to 350°C and 500°C. The motivation is to use an optimal value to increase the growth rate of the semiconductor layer.

With regard to claim 9, Rosenblad et al. disclose a growth rate is in a range between 1.5 nm/s and 4 nm/s (p. 90, right-hand column, paragraph 3).

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 6 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rosenblad et al. "Low-temperature heteroepitaxy by LEPECVD", Thin Solid Films 318 (1998) pp. 11-14.

With regard to claim 6, Rosenblad et al. disclose a thin silicon buffer layer is formed on the substrate prior to the forming of the semiconductor layer, said thin silicon buffer layer is formed at a substrate temperature of 600 °C (p. 11, right-hand column, paragraph 1 – p. 14, left-hand column, paragraph 1) but not preferably being formed in a range between 700°C and

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750°C. This claim limitation is prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and In re Aller, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious). It would have been obvious to one having ordinary skill in the art at the time the invention was made to adjust the temperature from 600°C to between 700°C and 750°C. The motivation is to use an optimal value to increase the growth rate of the semiconductor layer.

With regard to claim 13, Rosenblad et al. disclose a further step is carried out after the forming of the semiconductor layer, during said further step a second semiconductor layer being formed having a Germanium concentration of 30% said second semiconductor layer being formed at a second substrate temperature (p. 11, right-hand column, paragraph 1 – p. 14, left-hand column, paragraph 1) but not in a range between $50 < x < 100\%$. This claim limitation is prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA) (discovery of

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optimum value of result effective variable in known process is ordinarily within skill of art) and In re Aller, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious). It would have been obvious to one having ordinary skill in the art at the time the invention was made to having a Germanium concentration in a range between $50 < x < 100\%$. The motivation is to use an optimal value to increase the growth rate of the semiconductor layer.

10. Claims 2, 10, 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rosenblad et al. "Epitaxial growth at high rates with LEPECVD", Thin Solid Films 336 (1998) pp. 89-91.

With regard to claim 2, Rosenblad et al. do not explicitly teach forming of the semiconductor layer takes less than 5 minutes, preferably between 1 and 4 minutes. This claim limitation is prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and In re Aller, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious). It would have been obvious to one having ordinary skill in the art at the time the invention was made to form the semiconductor layer between 1 and 4

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minutes. The motivation is to use an optimal value of time to increase the growth rate of the semiconductor layer.

With regard to claim 10, Rosenblad et al. do not explicitly teach a semiconductor layer after completion of the deposition has a thickness in a range between 100 nm and 800 nm. This claim limitation is prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and In re Aller, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious). It would have been obvious to one having ordinary skill in the art at the time the invention was made to form the semiconductor layer between thickness in a range between 100 nm and 800 nm. The motivation is to use an optimal value thickness for use in a thin film MOSFET.

With regard to claim 11, Rosenblad et al. disclose a semiconductor layer shows a self-relaxation during the formation so that the semiconductor layer but does not show after completion of the formation has a relaxation of more than 75%. This claim limitation is prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang,

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40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also *In re Boesch*, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and *In re Aller*, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious). It would have been obvious to one having ordinary skill in the art at the time the invention was made to form the semiconductor layer with a relaxation of more than 75%. The motivation is to use an optimal relaxed semiconductor layer for use in a thin film MOSFET.

With regard to claim 12, Rosenblad et al. disclose a surface roughness of 2.8 nm (p. 90, left hand column, paragraph 1– p. 91, right hand column, paragraph 1). Rosenblad et al. do not teach a surface roughness (rms) of less than 1.8nm and/or a peak-to-valley height difference of less than 5nm. This claim limitation is prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. *In re Woodruff* 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also *In re Boesch*, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and *In re Aller*, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious). One having ordinary skill in the art at the time the invention was made would recognize that the process steps

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as disclosed could result in a surface roughness (rms) of less than 1.8 nm and/or a peak-to-valley height difference of less than 5nm.

11. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Rosenblad et al. "Low-temperature heteroepitaxy by LEPECVD", Thin Solid Films 318 (1998) pp. 11-14 in view of Hackbarth et al. "Alternatives to thick MBE-grown relaxed SiGe buffers", Thin Solid Films 369 (2000) pp. 148-151.

With regard to claim 16, Rosenblad et al. disclose the claimed subject matter except whereby an annealing step is carried out after completion of the forming of the semiconductor layer, said annealing step preferably being carried out at a temperature in a range between 600°C and 870°C. Hackbarth et al. teach alternative methods of growing relaxed SiGe buffer layers, one method being LEPECVD in which after the completion of the semiconductor layer an annealing step is performed at 800°C (p. 149, left-hand column, paragraph 1). One having ordinary skill in the art at the time the invention was made would recognize the need for an annealing step for oxide removal.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sonya D. McCall-Shepard whose telephone number is 571-272-9801. The examiner can normally be reached on Monday - Friday 8:30-5:00 E.S.T.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Landau can be reached on 571-272-1731. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/S. D. M./
Examiner, Art Unit 2813

/W. David Coleman/
Primary Examiner, Art Unit 2823